

## UPPER TRISHULI-1 HEP (216MW)

Client	Doosan Heavy Industries & Construction
DHI's Subcontractor	Power Construction Corporation of China

## REPLY COMMENT

Subcontractor	Power Construction Corporation of China
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### Incoming Document

Title of the Document	<b>Excavation and Initial Support Drawing of Adit No. 3</b>		
Document/Drawing No.	UT1-C-150-CVL-DG-43004 (4 sheets)	Revision	E
Review Document No.	<b>OE/TJ/UT1/OUT-SITE-DHI-003</b>	Reviewed Note No.	<b>RN-0051</b>
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### Outgoing Document

Previous Reply No.	<b>RC-0002</b>	Previous Reply Date.	<b>21.12.2021</b>
Reply No.	<b>RC-0011</b>	Reply date	<b>31.01.2022</b>

### General Comments

As previously noted, it is recommended that a separate drawing is produced for the junction of Adit No. 3 with the Headrace Tunnel. The adit needs to be enlarged to the vertical size of the Headrace Tunnel shortly before entering the junction. This is necessary to drive the Headrace Tunnel "full face" from the junction towards upstream and/or downstream. Otherwise, additional, time consuming reprofiling of the junction and the Headrace Tunnel at the junction is required, which shall be avoided. Likewise, the junction needs a support that is designed for the junction and its effective span.

**Reply: Accept. The junction please refer to the 4/5 sheet of this drawing.**

In addition, a concrete plug will be placed in the adit close to the junction - later in the project. For this reason, it is of great advantage to open the adit to the required "plug profile" when driving the adit towards the junction. If this is not done, the excavation profile may need to be enlarged in the section of the plug. The support of the adit (shotcrete and dowels) may also need to be removed in this section prior to grouting and placing the concrete plug, if this section is not opened to the "plug profile" when driving the adit towards the junction.

**Reply: Accept. The junction has designed please refer to the revised drawings and the calculation please see the surrounding rock stability calculation of adit No.3.**

The main items which need still revision are:

- Shotcrete strength for the tunnel shall be C25.
- Class II requires systematic bolting above the springline in addition to the 50 mm PFRS.
- Turning Bay needs to be properly designed (shotcrete thickness, pattern/length of rock dowels).

Reply: Accept.

**UT1-C-150-CVL-DG-43004-01 (sheet 1/4)**

- a) Make reference to new drawing of plug/junction with Headrace Tunnel.

Reply: Accept. The reference number has been added.

- b) Add new drawing in list.

Reply: Accept. The reference drawing has been added.

**UT1-C-150-CVL-DG-43004-02 (sheet 2/4)**

- a) Delete this comment on geology as this is always the case.

Reply: Accept.

- b) Change shotcrete strength to C25.

Reply: Accept.

**UT1-C-150-CVL-DG-43004-03 (sheet 3/4)**

- a) Add a note that the Turning Bay requires (re-)design regarding shotcrete thickness and rock bolt pattern/length prior to opening the bay or submit such design and add the findings in the drawing.

Reply: Accept. The turning bay has been designed please refer to the surrounding rock stability calculation of adit No.3.

- b) See notes below.

Support pattern	Class I	Class II	Class III	Class IV	Class V
Rock mass quality	$Q > 40$	$10 < Q < 40$	$4 < Q < 10$	$1 < Q < 4$	$Q < 1$
Rock dowel	Spot bolting D25 L=3m (where necessary)	Spot bolting D25 L=3m (where necessary)	Pattern bolting D25@2.0m, L=3m (alternative)	Pattern bolting D25@1.5m, L=3m (alternative)	Pattern bolting D25@1.0m, L=3m (alternative)
Shotcrete	—	T=50mm(PFRS)	T=80mm(PFRS)	T=100mm(PFRS)	T=160mm(PFRS)
Steel support	—	—	—	MB150@1.0m or (lattice girder @1m) (where necessary)	MB150@1.0m or (lattice girder @1m)
Supplementary support	—	—	—	Forepoling grouted dowel, D25@0.4m, L=6m (where necessary)	Forepoling grouted dowel, D25@0.4m, L=6m
Unsupported span for shotcrete(m)	—	9	4	3	0.5~1.0
Unsupported span for rock dowel(m)	—	6	2	1.5	0.5~1.0
Unsupported span for steel support(m)	—	—	—	0.5~1.0	0.5~1.0
Excavation span(m)	3	3	2	1.0~1.5	0.5~1.0
Excavation method	Blasting/Mechanically				Mechanically

- a) Class II requires systematic dowel pattern.  
b) Shotcrete thickness for Class III in temporary tunnels 80 mm, in permanent tunnels 100 mm (as previously in Class IIIb).  
c) Class III: for shotcrete 2.0 m, for dowels 4.0 m.  
d) Class IV: for shotcrete 1.5 m, for dowels 3.0 m.

Reply: a) Accepted and revised.

b) Accepted and revised.

c) Accept and revised.

d) Accept and revised.

#### UT1-C-150-CVL-DG-43004-04 (sheet 4/4)

a) Systematic dowels in roof.

Reply: Accepted and revised.

b) Shotcrete thickness for Class III in temporary tunnels 80 mm, in permanent tunnels 100 mm (as previously in Class IIIb).

Reply: Accepted and revised.

c) Dowels in sidewalls need to be spaced narrower to take moments from steel rib.

Reply: Accepted and revised.